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An *a priori* Approach to Model Parameter Estimation and Uncertainty Analysis in Large Catchments of the Congo Basin.

Water resources planning and management within large river basins of Africa is an important issue, but there is always insufficient data over various temporal and spatial scales to formulate decision making strategies. Limited traditional sources of information imply that novel approaches to hydrological predictions have to be investigated, if models have to be applied. The focus in the past has been streamflow magnitudes and their variability in time and space. However, more recently, the importance of accurately quantifying related hydrological processes and predictive uncertainties has been emphasised; and this relies on a sound understanding of the processes, application of appropriate models and the acquisition of data to support the application of models. This study presents the results of applying a physically-based *a priori* approach to estimate the parameters of a semi-distributed hydrological model for predictions in large catchments of the Congo Basin. The approach is based on the understanding of the role played by the physical basin attributes in conditioning hydrological processes of catchments, and uses measurable basin physical properties to directly quantify the model parameters. In this approach, frequency distribution properties of the physical basin attributes are used to establish ranges of parameter inputs, representing uncertainty distributions of the model parameters. The uncertainty distributions are defined using the mean, standard deviation and distribution type and used to generate ensembles of the model predictions, which are assessed for consistency against the available streamflow data, where possible. While the results suggest that the approach is valuable for model parameter estimation of both gauged and ungauged areas of the basin, there remains a number of opportunities for reducing uncertainty and increasing confidence in the model predictions.